

1        Claims

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3            1.        A parking brake actuator mechanism for setting and releasing an  
4        automotive brake comprising:  
5                    a reversible drive motor having a rotary output gearing;  
6                    a pivot member driven by said drive motor output and mounted to be pivoted  
7        about a rotary support in an actuator housing in either direction;  
8                    a cable wind up wheel rotatably supported in said housing and having an operator  
9        a cable wrapped onto a perimeter of said wind up wheel to be wound up thereon upon rotation in  
10      one direction and unwound therefrom upon rotation in an opposite direction;  
11                    a clutch establishing a driving connection between said pivot member and said  
12      wind up wheel upon rotation of said motor in a brake apply direction;  
13                    said clutch including a release feature and said actuator mechanism including a  
14      fixed disengagement feature located to engage said clutch disengagement feature and cause  
15      consequent disengagement of said clutch upon continued rotation of said pivot member in a  
16      release direction.

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18            2.        An actuator mechanism according to claim 1 wherein said clutch  
19      comprises a wrapped spring clutch having an arm connected to said pivot member and windings  
20      wrapped over a drum surface on said wind up wheel, said spring clutch establishing a rotary  
21      driving connection between said pivot member and said wind up wheel by gripping of said drum  
22      surface.

1                   3.       An actuator mechanism according to claim 1 further including a  
2       pretensioned torsion developing spring connected at one end to said wind up wheel to urge said  
3       rotation thereof in a direction to create tensioning of said cable, said torsion developing spring  
4       anchored at another end relative said pivot member, whereby upon release of said clutch, said  
5       prewound torsion developing spring tensions said cable by urging wind up of said winding  
6       wheel.

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8                   4.       An actuator mechanism according to claim 1 wherein said motor driven  
9       output gearing is self locking to hold said cable in tension upon deactivating said motor.

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11                  5.       An actuator mechanism according to claim 4 further including a load  
12       sensor producing signals corresponding to said cable tension, and a control circuit connected to  
13       said load sensor deactivating said motor in response to receipt of a signal produced by a cable  
14       tension indicating a brake set condition.

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16                  6.       An actuator mechanism according to claim 1 further including a position  
17       sensor sensing the extent of releasing rotation of said pivot member and a motor control circuit  
18       connected to said sensor causing said motor to be deactivated after sufficient releasing rotation to  
19       insure engagement of said disengagement feature with said fixed feature upon continued rotation  
20       of said wind up wheel to disconnect said driving connection of said pivot member to said wind  
21       up wheel.

1                   7.       An actuator mechanism according to claim 6 further including a prewound  
2       torsion developing clock spring connected at one end to said wind up wheel to urge said rotation  
3       thereof in a direction to create tensioning of said cable, said torsion developing clock spring  
4       anchored at another end relative said pivot member, whereby upon release of said clutch, said  
5       prewound torsion developing clock spring tensions said cable by urging wind up of said winding  
6       wheel.

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8                   8.       An actuator mechanism according to claim 2 further including an auxiliary  
9       drum connected to said pivot member and located adjacent to said wind up wheel drum surface  
10      and having a drum surface matched thereto said wind up wheel drum surface so that said spring  
11      clutch grip both of said drum surfaces to reduce wear on said wind up wheel drum surface.

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13                   9.       An actuator mechanism according to claim 1 further including a manual  
14      release element selectively movable to disengage said clutch by engagement with said clutch  
15      disengagement feature.

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17                   10.      An actuator mechanism according to claim 9 further including a torsion  
18      developing clock spring connected at one end to said wind up wheel to urge said rotation thereof  
19      in a direction to create tensioning of said cable, said clock spring anchored at another end relative  
20      said pivot member, whereby upon release of said clutch, said pretensioned torsion spring tensions  
21      said cable by urging wind up of said winding wheel.

1                   11. An actuator mechanism according to claim 2 wherein said wind up wheel  
2    is rotatable upon a drive shaft extending to said pivot member and drivingly mated to a hole in  
3    said pivot mechanism to establish a rotary connection therewith.

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5                   12. An actuator mechanism according to claim 11 further including an  
6    auxiliary drum having a hole through which said drive shaft extends with a mating interfit  
7    therebetween creating a driving connection, said auxiliary drum having a drum surface matching  
8    said wind up wheel drum surface and adjacent thereto, said spring clutch received over both of  
9    said drum surfaces.

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11                13. An actuator mechanism according to claim 5 wherein said load sensor is  
12    connected to said cable to measure the tension therein.

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14                14. An actuator mechanism according to claim 5 wherein said load sensor is  
15    associated with a rotary support for said wind up wheel and measures a reaction force caused by  
16    said cable tension.

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18                15. An actuator mechanism according to claim 5 wherein said load sensor  
19    comprises a strain gauge mounted to a bracket supporting a rotary support for said pivot member.

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21                16. An actuator mechanism according to claim 3 wherein said wind up wheel  
22    has a cylindrical cavity formed therein and wherein said tensioning spring comprises a clock

1 spring disposed in said winding wheel cavity.

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3 17. An actuator mechanism according to claim 16 wherein said clock spring  
4 has an outer winding connected to a cylindrical outer wall defining said cavity.

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6 18. An actuator mechanism according to claim 16 further including a drive  
7 shaft extending through said winding wheel which is freely rotatable thereon, said drive shaft  
8 extending to said pivot member and engaged therewith to establish a rotary connection, said  
9 clock spring having an inner winding connected to said drive shaft.

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11 19. An actuator mechanism according to claim 1 wherein said pivot member  
12 comprises a sector gear and said motor output includes a pinion gear engaged with said sector  
13 gear.

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15 20. A method of actuating an automotive parking brakes comprising:  
16 wrapping an operator cable connected to operate said parking brakes around a  
17 rotatable wind up wheel;  
18 drivingly connecting a reversible electrical motor to said wind up wheel to enable  
19 winding or unwinding of said operator cable therefrom by selective operation of said motor in  
20 either direction;  
21 sensing the level of loading of said operating cable when operating said motor in a  
22 direction winding up said cable to apply said parking brake;

1                   deactivating said motor upon reaching a predetermined sensor loading of said  
2                   cable; and

3                   holding said cable in said load condition after deactivation of said parking brake;  
4                   and

5                   deactivating said motor after operation of said motor in a direction unwinding said  
6                   cable to release said parking brake.

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8                   21.       The method according to claim 20 wherein rotating of said wind up wheel  
9                   by said motor is done through a normally engaged clutch, and said clutch is disengaged after  
10                  continued operation of said motor in a direction unwinding said cable to release said parking  
11                  brake, and further including reengaging said clutch upon rotation of said wind up wheel by  
12                  operation of said motor in a direction tending to wind up said operator cable.

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14                   22.       The method according to claim 21 including applying a constant torsional  
15                  force to said wind up wheel tending to wind up said operating cable thereon sufficient to  
16                  eliminate slack but not sufficient to apply said parking brake whereby when said clutch is  
17                  disengaged a pretensioning is created in said operator cable prior to engaging said clutch.

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19                   23.       The method according to claim 22 including selectively manually  
20                  releasing said clutch to release said parking brake and reengaging said clutch upon activation of  
21                  said motor to reapply said parking brake.

1                   24. The method according to claim 20 including sensing said cable loading by  
2                   sensing a reaction force at the rotational support of said wind up wheel.

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4                   25. The method according to claim 21 wherein said clutch is disengaged by a  
5                   predetermined extent of rotation of said wind up wheel in a cable unwind direction.

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7                   26. The method according to claim 25 including sensing the position of said  
8                   wind up wheel when rotated in said unwind direction and deactivating said motor after sensing  
9                   an extent of unwinding motion sufficient to disengage said clutch.

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11                  27. The method according to claim 20 wherein said driving motor is drivingly  
12                  engaged with a wind up wheel by a disengageable clutch, and wherein said clutch is released by a  
13                  manual lever to manually release said parking brake.